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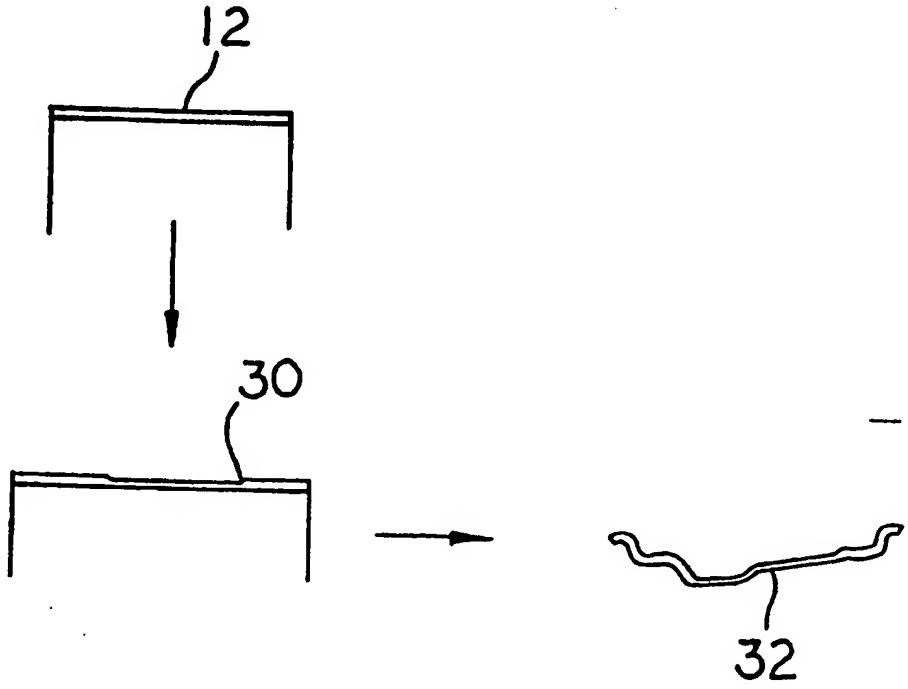
(54) Title: METHOD OF FORMING VEHICLE WHEEL RIMS

(57) Abstract

A method of forming vehicle wheel rims which includes the single pass spinforming of the rim blank prior to forming the rim profile. The spinforming operation stretches and elongates the blank to form a blank of non-uniform thickness prior to rim forming. The blank is then finished by the simultaneous profiling of the blank at its peripheral edges and reduced thickness area.



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METHOD OF FORMING VEHICLE WHEEL RIMS

Background of the Invention

This invention relates to a method of forming drop center passenger car and drop center truck wheel rims, and will have special application to a method of forming rims of a non-uniform thickness.

Conventional drop-center rims are formed from cylindrical blanks. Until recently, vehicle rims were formed of a uniform thickness material such steel or aluminum. The finished, formed rims were of a uniform thickness across the profile. This process of rim forming including the process of flaring, multiple rolling operations, and final expand-sizing is old and very well known to those skilled in the art.

Recently enacted governmental statutes and regulations concerning vehicle fuel economy requirements have led to the discovery of other methods of rim forming. Since one of the ways to improve fuel economy is to reduce vehicle weight, wheel manufacturers sought to develop materials and methods of reducing wheel weights. The introduction of lighter fabricated aluminum wheels made with rims formed from prior methods has achieved some success in attaining this goal.

Recently, it has been suggested that conventionally fabricated wheels could be formed of a non-uniform thickness across the peripheral rim portion to further reduce weight. By spinforming a narrower rim after profiling, a rim is produced with areas of reduced rim thickness in low stress areas between the outer tire bead seats. For example, see U.S. Patent 4,962,587. Utilization of this process further reduces wheel weight, but creates problems in the rim forming operation, namely bead seat eccentricity.

Summary of the Invention

The process of this invention reduces the weight of a rim by the spinning of the rim blanks to selectively reduce material thickness before they are passed on in the rim forming process.

Advantages over prior art include the following:

First, automation is easily applied due to the processing use of a non-contoured part. Second, the process is quicker because a three roller spinning machine may be used. Third, the spinning machine is easily incorporated between the blank preparation line and the rim forming line because that ar generally includes only chutes. Finally, the problem of bead seat eccentricity is eliminated.

The spinning machine which will preferably be used in this process is conventional and well known to those skilled in this art. The machine generally includes a plurality of rollers which contact the spinning blank to stretch and reduce the thickness the blank in a single pass prior to rim forming. The rim is finished by the simultaneous profiling of the blank at its peripheral edges and reduced thickness areas.

Accordingly, it is an object of this invention to provide for a novel ri... forming process which forms non-uniform thickness rims.

Another object is to provide for a process of forming lightweight vehicle wheels and rims.

Another object is to provide for a rim forming process which is efficient, economical, and easily adapted into current rim forming lines.

Other objects will become apparent upon a reading of the following description.

Brief Description of the Drawings

Fig. 1 is a schematical view of the process steps of this invention.

Fig. 2 is a schematical view of the process used to form conventional constant thickness rims and reduced-thickness rims proposed by this invention as used in press-fitted wheel assemblies.

Fig. 3 is a schematical view of the process as used to form rims for full-face wheels.

Fig. 4 is a schematical view of a conventional rim forming process.

Fig. 5 is a schematical view of the blank forming process used in this invention.

Fig. 6 is a schematical view of the rim profiling process used in this invention.

Fig. 7 is a schematical view of an alternative blank forming process used in this invention.

Description of the Preferred Embodiment

The preferred method herein described is not intended to be exhaustive or to limit the invention to the precise details disclosed. It has been chosen and described to best explain the principles of the invention, and its application and practical use to enable those skilled in the art to follow its teachings.

Referring now to the drawings, reference numeral 10 refers generally to the steps used in the rim-forming method of this invention. The steps are shown in block diagram form in Fig. 1 with a cross-sectional wheel rim profile at each step located above the corresponding block.

Drop-center vehicle rims are generally formed by a multi-step process which begins with the forming of a cylindrical rim blank 12 having a sidewall 13

with peripheral edges 15. Blank 12 is formed from a flat piece of steel or aluminum alloy of a specified length and width which determines the diameter and width of a finished rim.

As is conventional in the art field, the sheet metal is rolled into a cylinder and butt welded in the blank forming line 14 to form blank 12. The machines designed to form blanks 12 are conventional and may take on any commercially acceptable form.

In a conventional rim forming process (2A and 3A) the blank 12 is delivered through a chute (not shown) to a rim forming line 16, shown in block diagram form in Fig. 1. The rim forming line 16 is also a conventional series of machines, available commercially from several manufacturers, and includes a plurality of forming operations (see Figs. 4A-4G) which contour the blank 12 into a finished rim 18. Typically, a finished rim 18 (20) will include peripheral bead seats 22 (24) connected by center profile 25 (26). The resulting rim 18 (20) is of a uniform thickness across the entire width as shown, with minor thickness reductions at radii.

Figs. 2B, 2C, 3B, 3C, 5, 6, and 7 illustrate schematically the method of this invention. As in the conventional process, blank 12 is produced in blank forming line 14 and, preferably, expanded to an accurate specific consistent inside diameter by an expander 29. (Fig. 5B). Blank 12 is then delivered to a spinforming machine 28, which is a commercially available machine well-known in this art field. Machine 28 typically includes two or more rollers 29 which contact the rotating clamped blank 12 (see Fig. 5C) to form the spinformed blank 30 shown in Figs. 2B, 3B, and 5D. At a location inwardly spaced from one outer marginal edge of blank 12 and in one single pass, the rollers first move radially

inwardly to reduce the wall thickness of the blank between the mandrel and the rollers to the desired final rim thickness. Thereafter, the rollers move laterally relative to and across the rim blank toward the other marginal edge of blank 12 which causes the blank to stretch or increase in width. The rollers continue this lateral movement until they are located a specific distance from the other outer marginal edge of the blank (see Fig. 5C) at which time the rollers move radially outwardly from the now spinformed blank 30.

At both the beginning and ending of the single pass roller spinforming operation above-described, the rollers can be progressively moved simultaneously radially inwardly and laterally or radially outwardly and laterally, as the case may be, from the rim blank. This forms at each of the marginal edges of the now spinformed blank a transition in material thickness from the reduced center portion of specific thickness to each marginal portion of what was the original blank 12. Additionally, the reduced center portion of the spinformed blank when being formed in one pass can be moved radially outwardly relative to the blank to produce one or more areas of desired increased thickness in the finished rim to allow for desired design parameters.

Spinformed blank 30 is then delivered to rim forming line 16 where the blank is first flared at or about both peripheral edges by the simultaneous engagement of two opposing dies 31 as the blank is spun (see Fig. 5D) to form a flare spun blank 30' is seen in Fig. 5F. Alternatively, as shown in Fig. 7, blank 12 can be flared first by the simultaneous engagement of dies 31 and then spinformed as above-described by a single pass at its center portion.

Blank 30' is then roll formed or profiled in a series of forming operations by dies 33 each of which simultaneously forms both peripheral edges of the blank

(see Figs. 6B, 6C and 6D). Lastly, the profiled blank 30" is expanded to final size (see Fig. 6E) to form a rim 32 as seen in Fig. 6F. Rim 32 has a thinner portion of metal near the center, as shown, which allows the rims 32 to be formed of lower weight than the conventional rims 18, 20. This process can be used to form rims 32 for both press fitted wheels (Fig. 2B) and full face wheels (Fig. 3B).

When forming full face wheels (Fig. 3C), the blank 34 prior to it being spinformed to reduce the center portion of the rim is flared at one peripheral edge while simultaneously supported at its other peripheral edge. After the flared blank 36 is spinformed, it is roll formed or profiled by a series of profiling dies similar to dies 33 which simultaneously form both peripheral edges of the blank. Lastly, the profiled blank is expanded to final size to form rim 38.

The process of this invention has specific, but not limited use for drop center passenger vehicle and drop center truck rims. It utilizes generally simple machines which produce an accurate, concentric, and economical wheel. The simultaneous forming of both peripheral edges of the wheel blank after spinforming produces an accurately concentric rim, unlike the rims formed in U.S. Patent 4,962,587.

It is understood that the above description does not limit the invention to the given details but may be modified within the scope of the following claims.

I Claim:

1. A process for making vehicle drop center wheel rim comprising the steps of:

a) first forming a rim blank of uniform material thickness having a cylindrical sidewall with spaced peripheral edges;

b) then forming an area of reduced thickness in said blank between said blank peripheral edges by spinning the blank along an axis of rotation and contacting the exterior of said spinning blank by a forming roller moving once across the blank between the blank peripheral edges and in contact with the blank to stretch the blank at its said area of reduced thickness; and

c) profiling said blank from its said exterior by the forming contact at said blank peripheral edges and at said area of reduced thickness by a die during spinning of said blank to form said wheel rim.

2. The process of claim 1 including the step of flaring said blank at at least one of said blank peripheral edges prior to said profiling.

3. The process of claim 2 wherein said step of flaring includes the simultaneous flaring of both said blank peripheral edges.

4. The process of claim 1 wherein step b) includes moving said forming roller towards said axis in contact with said blank to a specific depth correlated to said area of reduced thickness.

5. The process of claim 4 wherein step b) further includes moving said forming roller across said blank as the roller moves towards said axis in contact with said blank.

6. The process of Claim 1 and including, following step a) and before step b), the expansion of said blank to a desired internal diameter.

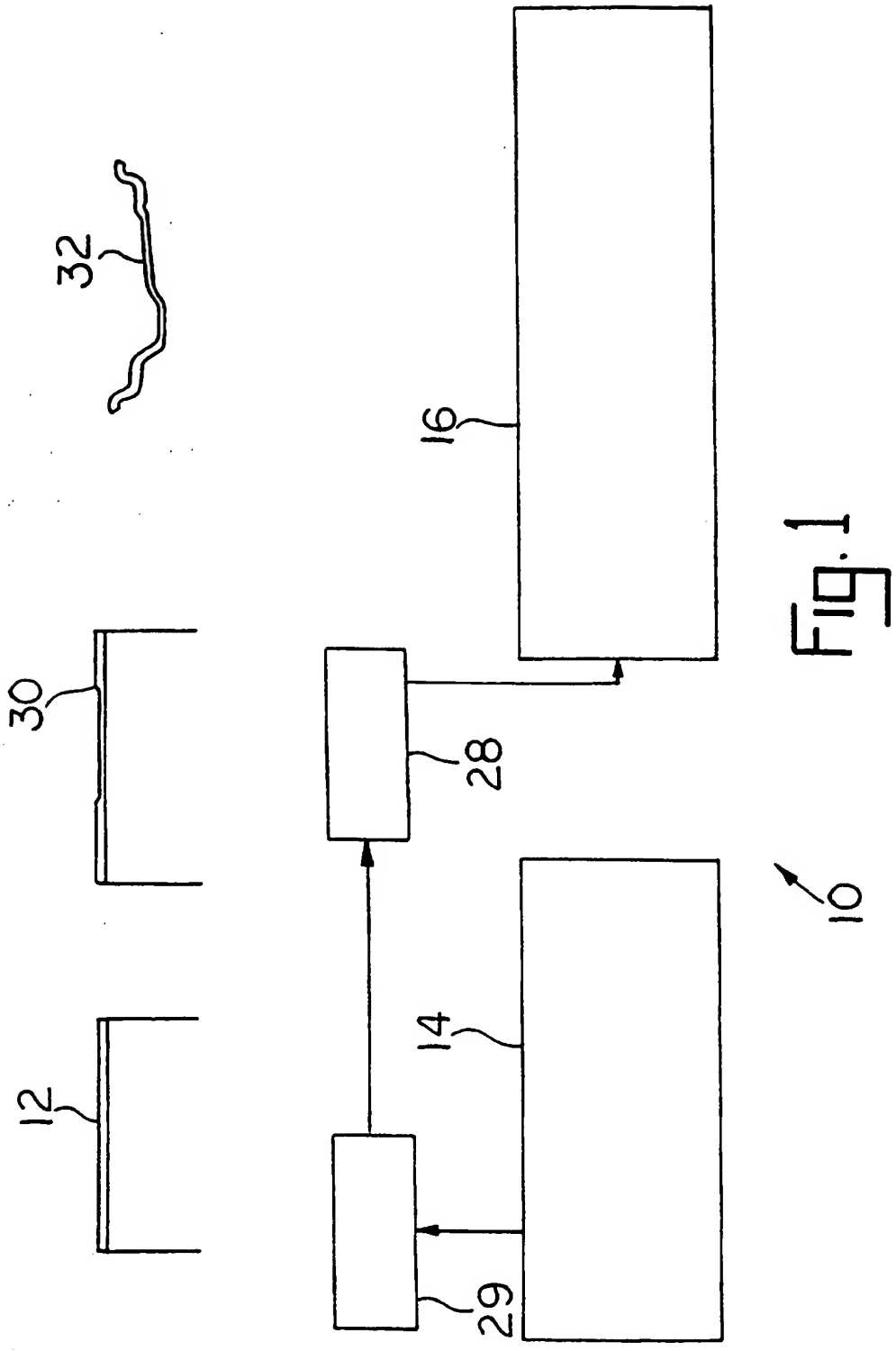


Fig. 1

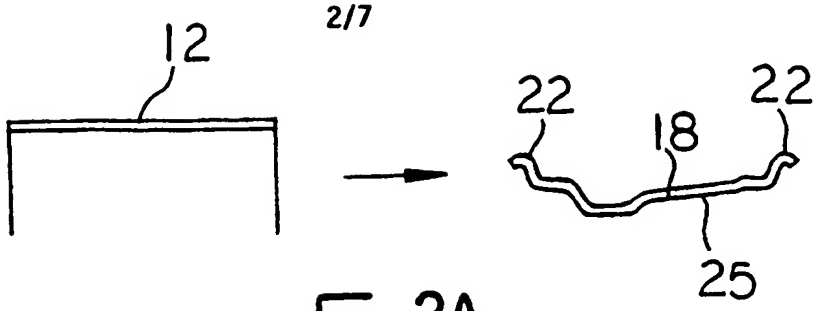


Fig. 2A

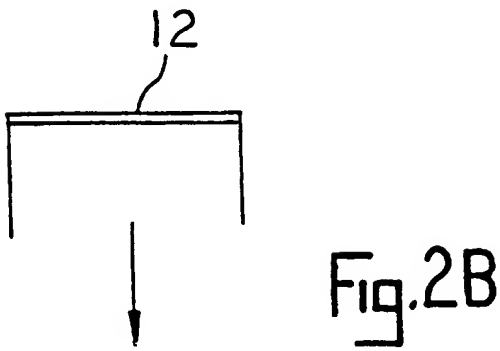
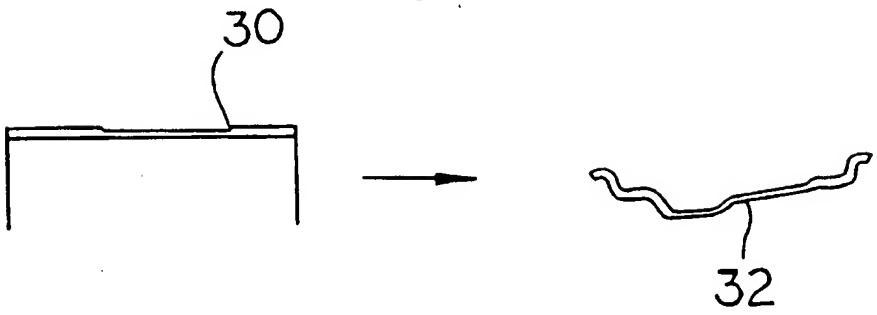


Fig. 2B



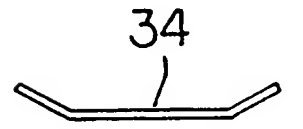
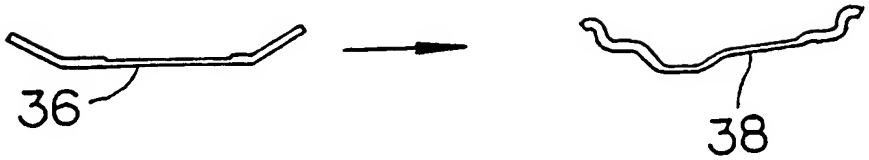


Fig. 2C



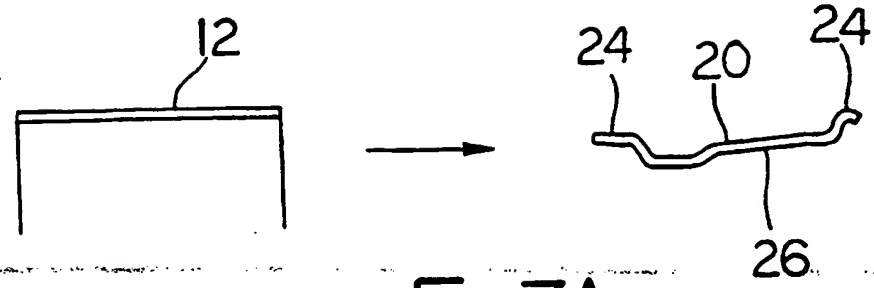


Fig. 3A

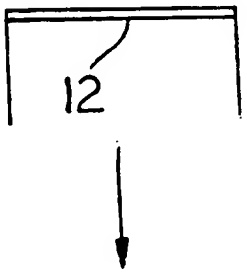


Fig. 3B

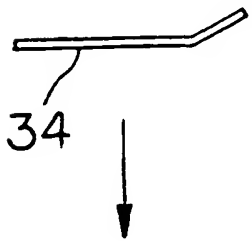


Fig. 3C

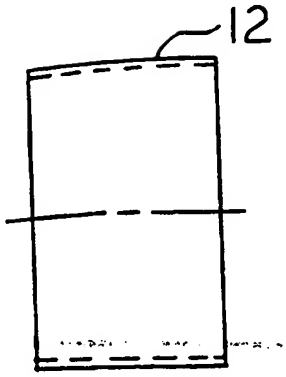


Fig. 4A

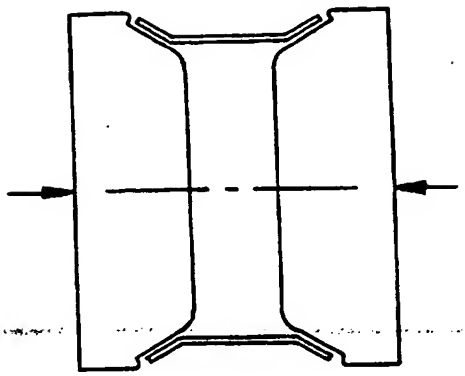


Fig. 4B

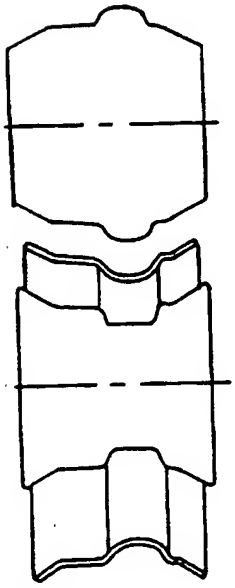


Fig. 4C

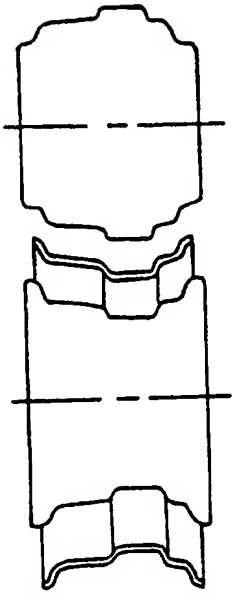


Fig. 4D

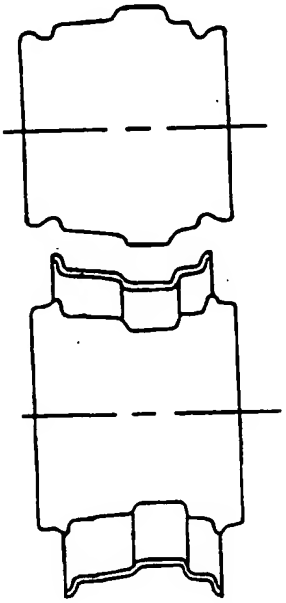


Fig. 4E

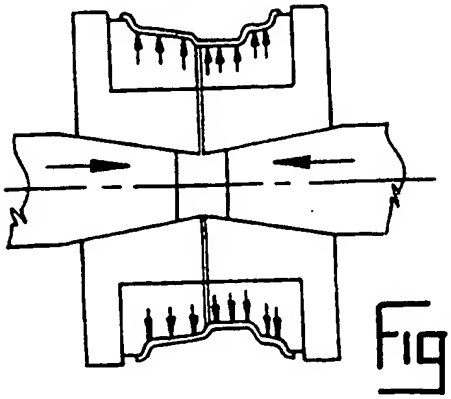


Fig. 4F

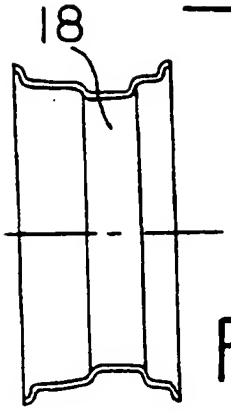


Fig. 4G

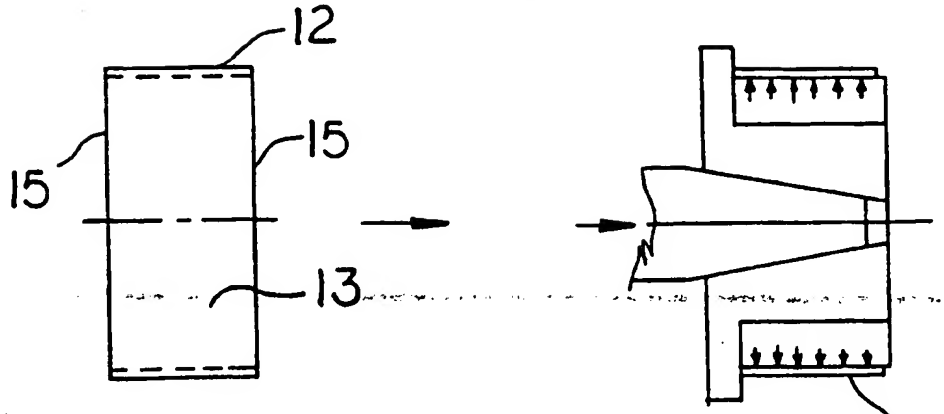


Fig.5A

Fig.5B

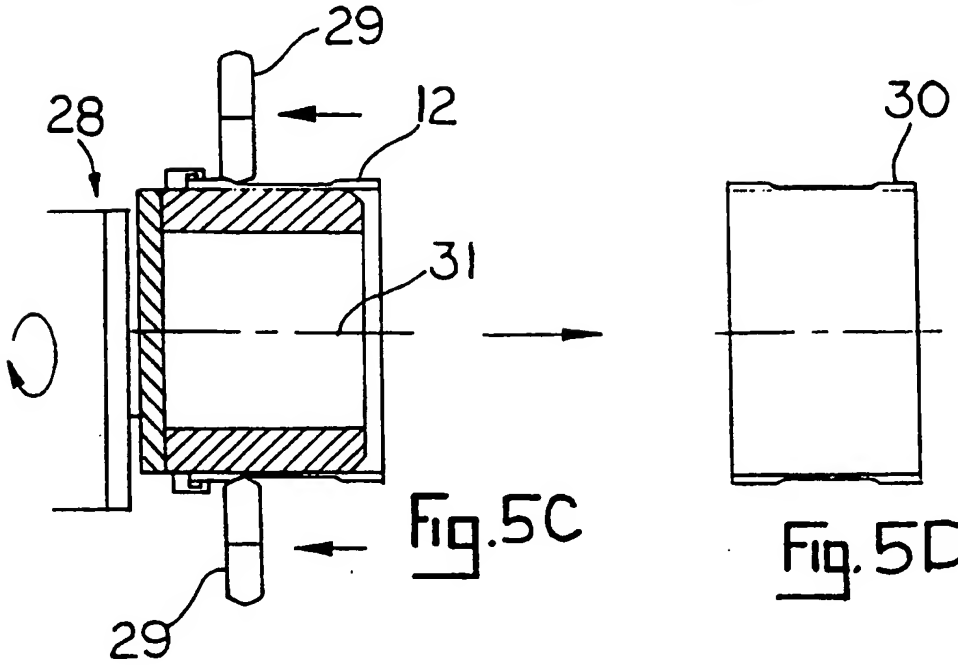


Fig.5C

Fig.5D

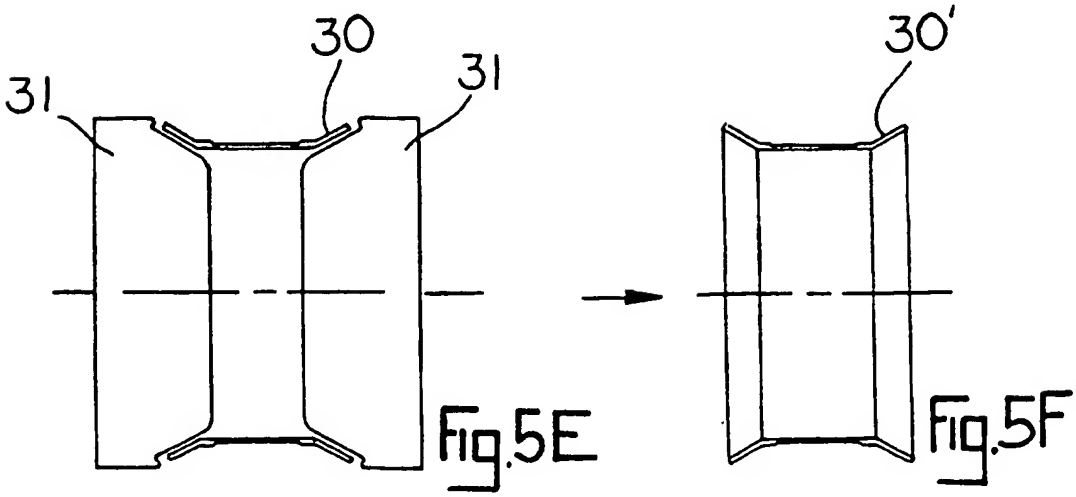


Fig.5E

Fig.5F

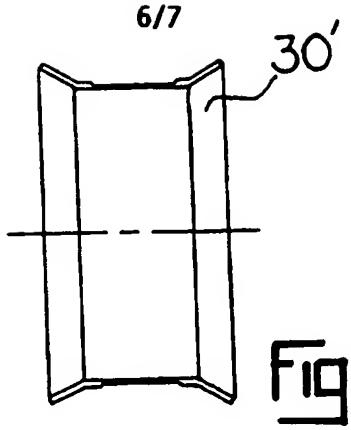


Fig.6A

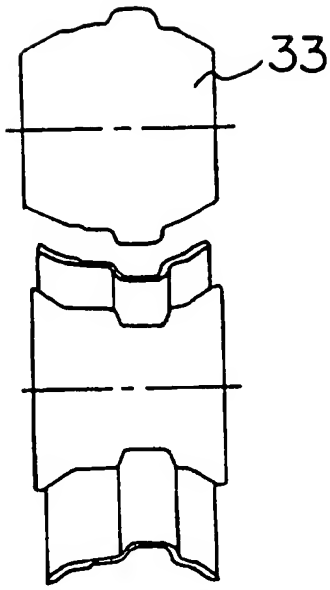


Fig.6B

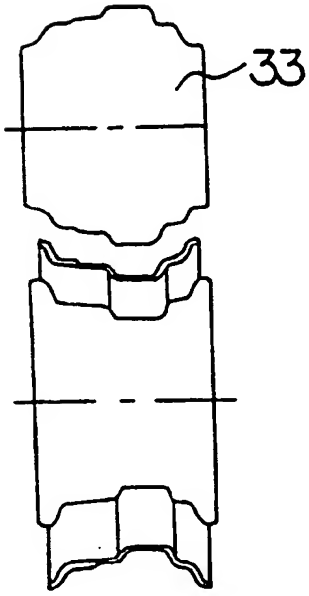


Fig.6C

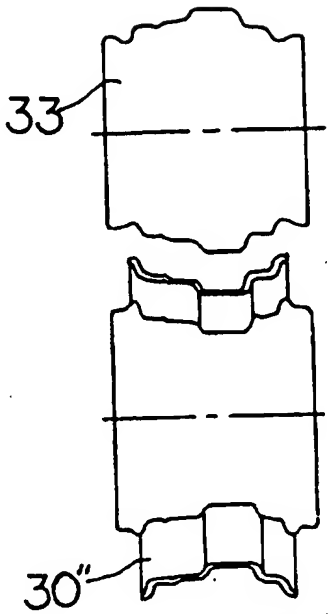


Fig.6D

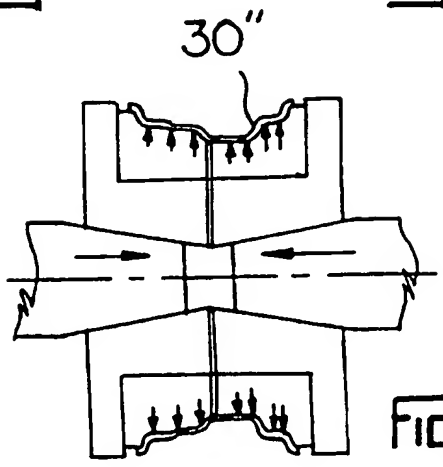


Fig.6E

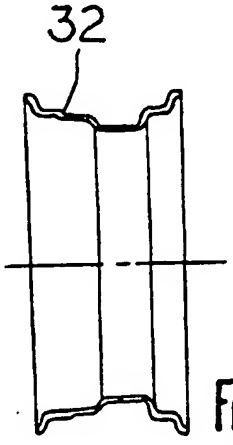


Fig.6F

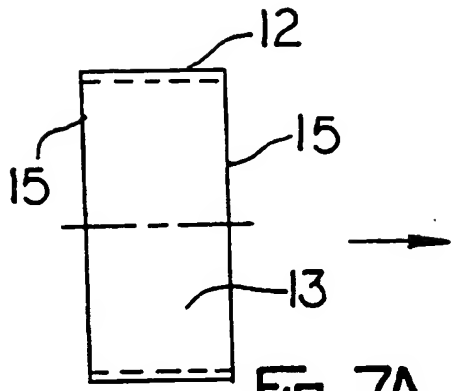


Fig. 7A

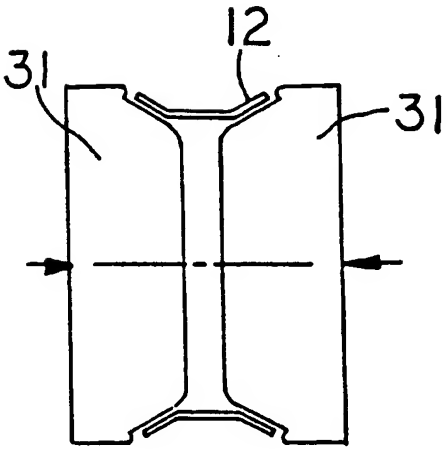


Fig. 7B

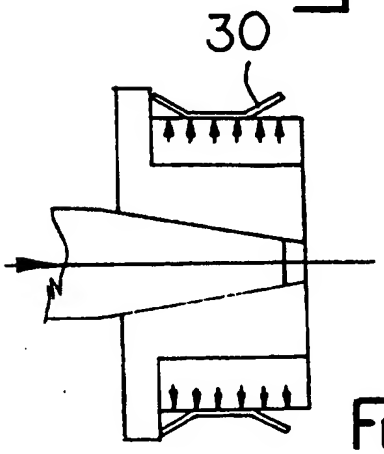


Fig. 7C

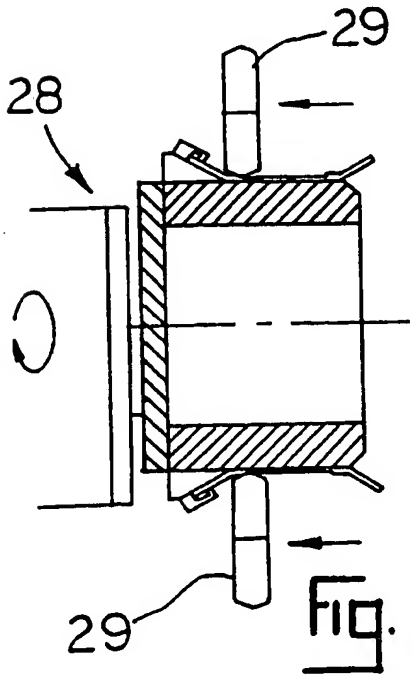


Fig. 7D

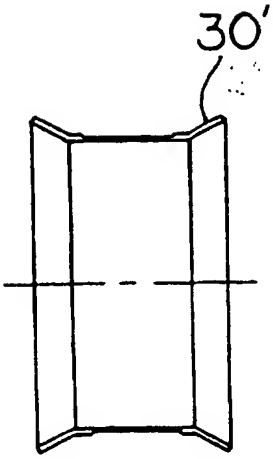


Fig. 7E

INTERNATIONAL SEARCH REPORT

Interna l Application No
PCT/US 95/12657

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B21D53/30 B21D22/16 B21H1/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO-A-95 11768 (HAYES WHEELS INTERNATIONAL, INC) 4 May 1995 see figures 1-9,12	1-6
X	JP-A-04 055 029 (CHIYUUOU SEIKI KK) 21 February 1992	1,4,5
Y	see figures 1-5	2,3
X	PATENT ABSTRACTS OF JAPAN vol. 16 no. 245 (M-1260) ,4 June 1992 & JP,A,04 055029 (CHIYUUOU SEIKI KK) 21 February 1992,	1,4,5
Y		2,3

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
16 January 1996	19. 02. 96
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Authorized officer Ash, R

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INTERNATIONAL SEARCH REPORT

Interna l Application No
PCT/US 95/12657

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